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THE ART OF MEDICINE[1]

By Professor DAVID RIESMAN

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IF I indulge to-day in a panegyric of the art of medicine, it is not with any intention to disparage the science of medicine. Far be it from me to do so. I was trained in pathology and taught that fundamental branch for eight years before engaging exclusively in the teaching and practise of internal medicine. I may therefore lay some claim to an interest in the sciences. But I am here to-day through the courteous invitation of Dr. Locke to speak of medicine as an art by which is meant medicine as it applies to the care of the patient in contrast with medicine as a branch of the science of biology of which we proudly claim it to be a part. When I contrast the two branches of medicine—the art and the science—it must not be inferred that they are separable in the doctor's daily work. Dr. John Brown, the gentle author of "Rab and His Friends," long ago said that art uses one eye and science the other but wisdom uses both. It is for this wisdom arising through a union of science and art for which we must strive as students and as practitioners of medicine.

The art and the science of medicine are like the two sides of a shield; neither can exist alone; neither by itself can achieve the grand goal for which medicine has been striving through the ages—to relieve suffering and to prevent disease.

In its composite character of art and science medicine does not differ from some other occupations, from that of the blacksmith or that of the mason. I can illustrate what I mean by a story. I once wanted a stone wall built from my house to the garage—a simple wall slightly curved. Any mason knowing the science of putting one stone upon another, of dropping a perpendicular, should have been able to do it. But upon inquiry I was advised to get an Italian mason because the Italians, so I was told, had a natural feeling for stone and would give me a more beautiful wall. And that is what happened—the wall is a work of art. It has something that the mason who only knows how to cut stone and mix mortar and pile one block upon another by the plumb

[1] Address delivered by invitation to the students of the Harvard Medical School, November 19, 1930.

line could not have achieved. And is not the same thing true, *mutatis mutandis,* of the doctor and of the blacksmith? There is science in everything and there is art in everything. When the wool workers of Florence wanted to provide the baptistry with bronze doors, they established a competition. The competitors were to make a panel depicting the sacrifice of Isaac by Abraham. Brunelleschi and Ghiberti were the chief contenders and both fulfilled the requirements as to subject and size of panel. It needs, however, only a glance at the two designs to reach an immediate decision in Ghiberti's favor. His was the greater art. Hence those wondrous gates that Michelangelo said were fit to be the gates of Paradise.

It is possible to fix an approximate date in history for the beginning of the science of medicine. Some think it began in a feeble way with Herophilus of Alexandria. Galen, the 2000th anniversary of whose birth has recently been celebrated in Philadelphia, made a better beginning but after him the scientific or as we might also call it the experimental side of medicine slumbered for nearly fifteen hundred years; virtually until Harvey's discovery of the circulation of the blood in 1615.

The art of medicine, the care of the patient on the other hand, goes back in an unbroken tradition to the very beginnings of the healing art. It must have begun in what Dolley calls the dusk of prehistoric time. Astronomy is the only branch of human knowledge that might vie with medicine in length of lineage. The spirit that has animated the art of medicine in these long ages is beautifully expressed in the name of the first physician recorded in history—the great Egyptian Imhotep, whose name means "He who cometh in peace."

What do we understand by the art of medicine? The phrase, as I have said, is largely though not wholly synonymous with that of the care of the patient. In actuality, however, it has a much wider connotation for it concerns itself not only with the sick individual but with the totality of his environment—his family, his friends, his occupation, his social and pecuniary status; indeed with everything that can favor or retard his recovery from illness. In the past we have taken a too narrow view of our task in caring for the sick human being for we have been interested only in the patient or in his disease. Largely through the work of Dr. Richard Cabot and his school a wider horizon has been opened to us with incalculable benefit to the sick and with a nobler position of the art of medicine. We have come to realize that it is not sufficient to prescribe for the patient and to lay down rules for his diet, for his time of rest and of work. We must go beyond these undoubtedly necessary matters and learn the conditions at home, whether the diabetic patient is getting the right diet, whether the child is getting the needed food and sunshine, whether the conditions of living are made suitable for the nervous and maladjusted patient. We must remember the influence of sickness upon dependency and delinquency; the demonstrated relation between these is an added spur for giving to the patient's relation to the outside world every possible thought and effort.

I can not leave this phase of my theme without paying a tribute to the social workers whose cooperation has so greatly facilitated in our day the care of the patient.

The principles of the healing art have not greatly changed since the beginning although the advance of civilization has brought about certain modifications in practise, for example, in the care of the insane and in the control of epidemics. The irrational attitude of the public and even of the profession which until recent times expressed itself, *e.g.,* in shot-gun quarantine against yellow fever, was due to ignorance and has been abandoned. Perhaps our present methods of quarantine against some of the contagious diseases are also based on false premises and will eventually disappear.

There are other noteworthy advances in the care of the sick that deserve a moment's notice. The fever patient is no longer smothered with blankets and suffocated in an hermetically sealed room. We have insulin, liver and arsphenamine for the treatment of three important diseases. But lest we become too vain, let me remind you of quinine for malaria, introduced into Europe just three hundred years ago, of vaccination against smallpox, 134 years old, of lime juice against scurvy (1770), of ether for anesthesia (1846) and of antisepsis against wound infection (1847), all of them initiated or developed before any one here was born.

I do not think I shall be challenged if I say that in his medical course as at present constituted the young student learns too little about the care of the patient. In certain places there is indeed a definite tendency to minimize the importance of the art of medicine and to imbue the student with profound faith in the laboratory as the Alpha and Omega of medicine. I doubt whether Hippocrates, incomparable observer that he was and wise above other men, could get a chair to-day in some of these superscientific medical schools. The first question that would be asked of him would be—"How long have you worked in a laboratory?" And I can see a fine tolerant smile playing about his sensitive lips as he replies, "I have done no laboratory work but I have studied disease diligently at the bedside. I know its constants and its vagaries. I know how to treat it."

Speaking of Hippocrates I am reminded that our medical schools not only neglect to some extent the practical aspects of the treatment of the sick but they also fail to touch that phase of the care of the patient upon which the Hippocratic school laid such stress, namely, prognosis. And yet the reputation of a physician often stands or falls more by his prediction than by his treatment.

Perhaps the care of the patient receives more consideration here at Harvard than elsewhere, because it is in this school that the traditions of Francis Peabody are felt and honored. In his beautiful swan song, "The Soul of the Clinic," Peabody has expressed in admirable language the true ideals of the teacher of the art of medicine.

The care of the sick can not be learned from books. It must be learned at the bedside, in the hospital or in the home. Harvey Cushing tells of a young physician who counted as the most valuable experience of his ten years of medical study a summer's substitution for a local doctor among an island colony. Never before had his powers of observation and his common sense been so thoroughly exercised. Although some hold differently, I believe that no one can become a great specialist who has not had some kind of practical bedside experience. There was much good in the old preceptorial system under which the young doctor accompanied the old doctor on his daily rounds and learned the art of medicine under a teacher who knew it. I am naturally much interested in the Wisconsin experiment of reviving this old custom.

As the result of the unilateral teaching of which I have just spoken, the student goes out into practise with the conviction that the laboratory is of supreme importance and that observation and study at the bedside are of secondary rank. Such blind dependence upon laboratory methods makes many otherwise excellent men of little use in the treatment of the sick. This fact was brought home to me and many others during the war. Men thoroughly familiar with laboratory technique but lacking the clinical spirit were, in the beginning at least, of little help in the wards during the influenza epidemic.

I recently asked a renowned artisan in wrought iron why the world was no longer able to build great Gothic cathedrals like that of Chartres. "To-day," he replied, "men are draftsmen, in those days they were craftsmen." This subtle distinction is applicable to the two types of medical men—the theoretically trained draftsman and the all-around doctor craftsman.

The tendency to ignore the human side of medicine in the patient through a predominating interest in his disease and in the laboratory reached its height in Germany, but lately the pendulum has begun to swing in the opposite direction and now one hears everywhere the slogan, "Back to Hippocrates." What is meant by this cry, back to a man who was born 460 B. C.? It means that medical men are coming to realize that in their otherwise laudable zeal for scientific methods, they have forgotten the true essence of their calling—the healing of the sick. Heilwissenschaft had displaced Heilkunst.

After these not wholly unnecessary digressions, I shall take up in detail the mixture of elements that constitutes the art of medicine. I shall first consider the subjective side of the art, that which deals with the personality of the doctor, and then the objective, which deals more directly with the care of the patient .

All writers of romance have put in the foreground of the ideal doctor's qualities sympathy. I am not altogether in agreement with these well-wishers or critics of our calling, for to me the most important quality in a doctor is understanding—the ability to fathom the psychology of the patient. Much of the good occasionally accomplished by the misguided followers of Mary Baker Eddy can be ascribed to an understanding of the human mind and of its influence upon the body.

The fact can not be disputed that the newer psychology especially psychoanalysis has sharpened our powers of understanding the subconscious mind and has given us a valuable means of treating certain types of nervous and mental diseases. I believe our medical schools are delinquent if they do not teach at least the elements of analytic psychology as it applies to the neuroses, to the psychoses, and to the problem child.

The quality of human understanding comprises the quality of sympathy. Sympathy, at least the active kind, is not always in place, for certain patients, the utterly selfish ones, frequently are best treated somewhat roughly. But under all circumstances the doctor must have pity, "I can not live without pity if I am to become a doctor."

Two other closely related qualities help to give the doctor personality—ambition and enthusiasm. They are prerequisite to self-improvement. The doctor who has them will be what every doctor should be—a student all his life. I like it when the doctors talk shop. My lawyer friends, I find, rarely talk law nor do they seem to read as many journals and magazines as the medical men. A physician who reads knows what is being done in Boston, Berlin, Brussels, Helsingfors, Frankfurt, Rochester and Vienna. The lawyer's intellectual contacts seem to be more limited; that is why I think medicine is a much better field than the law. While I proclaim this self-evident truth I nevertheless have a very high respect for the

lawyer who with equal conviction holds the direct opposite. The doctor's attitude as well as the lawyer's toward his calling must be like that of the blacksmith in "Daniel Deronda" who said, "For the life of me I can not see why anybody wants to be anything else but a blacksmith."

Next to understanding in importance comes confidence—confidence primarily in one's self for only he who possesses it can inspire confidence in others, and in the relation of doctor and patient confidence is everything. The author of San Michele asks, "What is the secret of success?" and answers, "To inspire confidence." Confidence is a magic gift granted by birthright to one man and denied another. The doctor who possesses this gift, says Axel Munthe, can almost raise the dead. The doctor who does not possess it will have to submit to the calling in of a colleague in consultation in a case of measles.

Experience and knowledge are the foundations of self-confidence. In their absence conceit may perhaps create self-confidence but it is then like an inflated bubble easily pricked.

Confidence in one's salf begets imperturbability—a magnificent asset in the crises of the sickroom. When the patient is in agony and the friends in despair the calm, well-poised, confident doctor is like a tranquil haven to a storm-tossed ship.

The doctor needs to be honest—I do not mean the vulgar honesty that the Philadelphia Quaker had in mind when he said to his son, "Be thee honest, James, but if thee can't be honest, be thee as honest as thee can." I mean intellectual honesty, the kind that scorns deceit and bluff.

The thought of intellectual honesty suggests another thought and that is the danger, the unwisdom, of becoming a fashionable doctor. A few years ago I called on a very distinguished physician in Harley Street in London. During the course of conversation I asked him about another man on Harley Street who is widely known as a clinician. "Oh," he said, "he is just a fashionable doctor." His tone spoke volumes. What he meant I am sure you can all imagine.

There are other elements that can not be left out of the category of qualities a doctor needs if he wants to exercise the art of medicine with success. Dignity is one of these. The dignity I have in mind does not depend on what is facetiously called the bedside manner, nor upon the cut of the clothes, nor upon the appointments of the office. I can best define it by saying what is absent from it—familiarity, gossipiness, pomposity and haste.

When I began the practise of medicine a young man had a hard time to succeed. My contemporaries and I were sure that the Vandyke beard, the frock coat and a few gray hairs were the *sine qua non* of success. As a concession to this sentiment, I grew a beard but as it was red and my hair was brown, the combination was by no means comely and I soon took the advice of well-meaning friends and of the looking glass and did away forever with the beard.

Punctuality, the politeness of kings, is a quality of much value in the doctor's relation to his patients and his colleagues. The patient has little patience. The late Dr. William Pepper, one of the busiest men of his generation, was remarkably prompt. Not only must a doctor be punctual but he must never appear to be in haste. It was one of Sir James Mackenzie's striking characteristics that no matter how pressed he was for time he never seemed hurried.

The doctor must have courage—a courage greater than that of the soldier who is sustained by the thrill of battle and the inspiring support of his fellows. The courage of doctors in all ages has never been surpassed. There are, of course, instances of lack of courage but they are few. You may remember that the great Thomas Sydenham was accused of deserting his practise when the plague broke out in London. It is told of Galen that he was once asked by Marcus Aurelius to accompany him on his campaign in Germany. Galen immediately had a very convenient dream in which Aesculapius forbade him to leave Rome, a divine command Marcus Aurelius did not dare to disobey.

I am not fond of the praise of those who sympathize with the physician because he has to make many sacrifices of those joys and activities of life upon which the average mortal sets so high a store. "Doctor, it must be hard for you to miss that opera, this play or that party." No, it is not at all hard except perhaps through the uxorial reflex, for the thing we do instead brings so much more durable satisfaction. Some wives may perchance express regret, but the ideal wife which nearly every doctor has shares her husband's feelings.

And now I come to the objective aspect of the care of the patient—the practical application of the art of medicine.

The visit of the patient to his doctor is an event of transcendent importance upon which the patient focuses all his thoughts, his hopes and fears. He is full of his story and wants to pour it out to a receptive listener. The doctor, therefore, must listen with patience and interest, he must avoid interruptions and when interruptions come, he must from a cultivated habit be able to bring back his mind at once to the patient's case.

The doctor must be a detective, a Sherlock Holmes, a Zadik, so as to elicit data intentionally or unintentionally concealed by the patient.

He must understand something of the laws of heredity which play a more important rôle in the majority of diseases than is dreamt of in our everyday philosophy. Furthermore, he must have some acquaintance with the newer concepts regarding the constitutional factors in disease, factors that are closely allied to heredity.

Study of the recent literature and bedside experience are the chief teachers in these newer but worthwhile fields.

After obtaining, often with infinite pains and self-control, the history, the doctor proceeds to make the physical examination. It is at this point that art and science meet. The doctor must know his tools, whether they be his hands, his eyes, the test-tube or the microscope. He must know how to make a physical examination. He must know the physiognomy of disease so as to recognize it when it is present.

After a thorough examination and a painstaking history, he should be able to arrive at a diagnosis and to apply treatment rationally.

Let your work be so thorough that when the patient leaves your office he will be able to say, "Such an examination I have never had before."

The subject of physical examinations reminds me to say a word about the cost of medical care, especially about the cost of laboratory examinations. Is it not the duty of every physician to minimize the expense to which the patient might be subjected by avoiding useless and uncalled for examinations? Expensive wholesale examinations not based on a thorough preliminary study are economically wasteful and reflect grievously on the good sense of the medical profession. Much of the criticism of the cost of medical care arises from this wide-spread practise of ordering indiscriminately all manner of examinations in every patient.

Medicine after all is not a matter of trial and error nor is the doctor's examination a *ballon d'emblée* but it is a purposive rational procedure based on a careful history and on an appreciation of the needs of a given case. There are occasions when difficulties of diagnosis may warrant the making of every possible test but they are rare.

What should the doctor tell the patient about his disease? There are some distinguished men who urge that the doctor tell the truth, the whole truth and nothing but the truth. I am inclined to think that those who give this advice have never had any desperate illness in their own families or at least have seen but little suffering among the people. When Dante inscribed above the doors of his "Inferno," *Lasciate ogni speranza voi ch'entrate*—all hope abandon ye who enter here—he showed his profound understanding of the human soul. He knew that the greatest thing men live by is hope.

The doctor must ever be careful not to banish hope even at times when there seems no hope. Does that mean to be false to truth? No, it only means that the doctor should temper his statements so as not to crush the spirits of the patient or his dear ones. There are cases that by every criterion are doomed, in which nevertheless a sudden turn may occur and recovery result. One not rarely hears the statement—the doctors had given him up but he got well.

I have seen recovery in cases of insanity that seemed utterly hopeless. A woman comes to my mind at this moment who had a profound melancholia. She tore out her hair, had to be fed forcibly and took on the appearance of an old hag. After about three years of abject and repulsive negativity, she began to improve and finally got entirely well, so well that she has been able to make several trips to Europe and one around the world.

But even in cases that experience tells us can not possibly recover, the humane doctor will so couch his statements that the family will be sustained during the last days or weeks of the patient's life.

A patient of mine had a serious coronary attack and seven years later had a second one while in Paris. The physician in attendance called a consultant who as soon as he had seen the patient said to the wife, "Madame, your husband is going to die." Put in that bald brutal way the dictum crushed her. She implored the attending physician to remain with her husband and to spare no efforts to save him. To every one's astonishment the man improved, so that the consultant on his next visit declared that he had been in error and that the patient would now recover. The wife was overjoyed. That night the man had another seizure and died.

What should the doctor have said? As I see the situation he should have said something like this: "Madame, your husband is very ill; his chances of recovery are not good. However, we shall not give up and shall do everything in our power to save him."

The question is often asked, "Doctor, shall I send for the children?" I usually reply, "It might be wise; if they find their father improved, they will be only too happy and if not, they will be grateful for letting them know the truth."

Keep the patient's confidence. If you get to be known as one who babbles, patients will keep from you important details of their lives that you need to know if you want to be successful in your treatment.

Coming now to specific advice on the question as to what to tell the patient, my counsel has been somewhat as follows:

If the patient has a serious disease, the knowledge of which might frighten or crush him, tell him the whole truth only if it is otherwise impossible to get his full cooperation. If he carries out the instructions

faithfully, it is unnecessary, it is cruel to tell him the worst.

In the case of tuberculosis conditions are somewhat different. A patient who does not know his disease may become a menace to others. Moreover, in the absence of an understanding of his malady he will rarely give that full cooperation which is vital for success in conquering the disease. Therefore, I always tell the patient the truth if he has tuberculosis. One need not be brutal about it—one can sugar-coat the pill but the pill must be administered.

Many patients have cancerophobia, that is they are convinced that somewhere in the body there is a cancer. If after a thorough examination I have come to the conclusion that there is no cancer, that the fear is groundless, I have sometimes found the following procedure very successful. If after the examination the patient asks me, "Doctor, do I have a cancer?" I say, "Yes, you have two or three." That generally causes him or her to smile and the fear vanishes.

If for legitimate reasons one conceals the true nature of a grave disease from the patient himself, one must as soon as possible apprize a member of the family. Not only is this a duty one owes to the family but it is also a matter of self-protection; otherwise the doctor may be accused of not having known the true nature of the patient's illness.

It is the doctor's duty if the patient has an illness that might suddenly terminate his life, such as angina pectoris, aneurysm, or excessively high blood pressure, to induce him in a tactful way to make his will.

In a doubtful case the doctor must always err on the side of hope but he must be honest not to rouse vain expectations when he is fairly convinced that the patient can not recover.

In connection with this general subject there is a kindred matter of which I want to speak. There are situations in which from the nature of things treatment is useless. If the case is one of long-standing suffering, such as cancer, the family nearly always prefer that the doctor do nothing to prolong the agonal period. They may, in fact, resent the torturing with injections of an already overtortured patient. There are cases, however, in which the family insist that the doctor spare no efforts, that he fight with death to the last moment. They resent it if he sits idly by with folded hands while the patient's life is ebbing away. What is his duty in such circumstances? If the family is an intelligent one, he can explain the futility of all further efforts, but where intelligence is conspicuous by its absence, it is good psychology to keep on. Only he who in the lonely hours of the night has fought with death over a dying child and has seen the gratitude in the eyes of the parents, knows the profound difference between theory and practice.

It is the doctor's duty to pay attention to the creature comforts of the patient. The poorer the patient, the more important it is for the doctor to give that phase of the medical art his attention.

Among the comforts of the patient the first place is occupied by a good nurse whether hired or "owned." A good nurse will see to it that the bed is clean and smooth, that the pillows are properly arranged—the arranging of the pillows is an art—that the light is satisfactory and the hangings not too garish. The importance of the hangings was brought home to me many years ago in connection with a typhoid fever patient whom I had seen in consultation. The young woman was convalescing from her fever but had become wildly delirious, crying out that she was being burned alive. The family and the doctor were greatly worried that her mental aberration might be permanent. However, I gave a good prognosis and outlined appropriate treatment. I did not see the patient again, but perhaps six months later a young woman walked into my office and said, "Doctor, I want to pay my bill." I did not recognize her. She said, "I am Miss Nichols. Perhaps you would like to know something about my delusions." "Surely," I said, "I remember the details very well." Then she told me that she attributed her delusions of fire and burning to the fact that the wall paper was red, red flowers were being sent to her, the screen around the bed was red and the nurse was fanning her with a red fan.

It goes without saying that proper food properly prepared and properly served is vitally important. Unfortunately even in the best hospitals one or more of these factors may fail.

A point of importance often neglected is the giving of specific directions. Early in my life I found it a good practise to write out for the caretaker, whether it was a member of the family or a nurse, the directions as to food, medicines, etc.

This applies also to prescriptions. It is unwise to say "take medicine as directed." The instructions should be specific and if the medicine is to be used externally, be sure to say "for local or external use."

Whatever treatment is instituted must be made to fit the patient's circumstances. It shows the doctor's lack of understanding and judgment if he suggests methods of treatment that the patient's station in life makes impossible of application. If the doctor in this year of grace should suggest to a broken-down broker that he go to the French Riviera for his bodily health, it might lay him open to a great deal of ridicule.

Visits of friends. Job's comforters are so ubiquitous that the majority of patients are better off without visitors although one must use judgment. Recently one of my patients, a man 69 years old, had

his tonsils removed. It was quite a shock to him. As he was convalescing and about ready to go home Bildad the Shuhite came to see him in the person of a business friend and told him this—"Don't go home too soon; a man I know went home the other day and had a terrible hemorrhage and nearly died."

Attendance at operations. Many a patient who is about to undergo an operation scarcely knows the surgeon when the latter is in his civics and not at all when he is garbed like a member of the Ku Klux Klan. What a comfort it is to have the family doctor standing by his side when the anesthesia is about to begin.

There is also a personal advantage to the doctor in being present at operations and that is he can learn a great deal more from the *autopsia in vivo* than from books.

Be present at death, it is a great comfort to the family who may need the staying influence of a sympathetic friend, one whose countenance like that of Conan Doyle's Dr. Seldon is in itself a consolation.

In discussing treatment of any given disease textbooks and teachers of medicine usually dwell upon the treatment of the disease during its course. Little attention is given to the treatment during the period of convalescence and yet that is a very important part of therapeutics. If the patient is recovering from some acute infectious disease like influenza, pneumonia, or typhoid fever, he can not return to work immediately; he has first to get back his strength, both mental and physical. He must receive instruction as to how much to sleep, how much to exercise, what to eat; in fact, how to live until he is himself again.

I have found that many surgeons entirely neglect the after-treatment of their cases. That neglect accounts for a certain proportion of recurrences or post-operative failures. If the surgeon will not take the trouble to instruct the patient how to live after a capital operation, then the medical man must be prepared to give the necessary advice. He must prescribe the patient's diet and his general course of life. I want to pay tribute to one of your fellow citizens who has done a great deal to focus the attention of the profession on the after-care of patients—Dr. John Bryant.

I often advise women patients who are convalescing to get up, put on corsets, stockings and the best dressing gown they possess. It will give them a sense of well-being. As Emerson understandingly expressed it, "The consciousness of being well-dressed is capable of yielding satisfaction that religion is powerless to bestow."

An essay on the care of the patient might properly include a section on that ticklish subject called medical ethics.

Among the lay public ethics commands about as much respect as the Volstead act in Chicago. They look upon our code as a sort of conspiracy for their undoing. That is because they do not understand it and also because sickness creates selfishness. Our ancient code is nothing more or less than a system of honorable dealing and in the last analysis is advantageous to the patient.

Much criticism is heard about consultations. Some of it is justified, although the strictures of Molière and the caricatures of Cruikshank hardly apply today. I believe in open consultations openly arrived at and whenever possible try to persuade the attending physician to have the family present.

I have known the doctor in attendance in cases in which there was a radical difference of opinion to ask the consultant to tell an untruth. That is unfair both to the patient and to the consultant. If the consultant is tactful, he can express his opinion without belittling or embarrassing the family physician.

And now, in concluding, I want once more to make it plain that indispensable as bedside experience is, it alone does not make a good doctor and if the Hippocratic ideal implied only bedside study, only the art of medicine, it would be an inadequate ideal. Believing this I have not been able to follow the late Sir James Mackenzie, for whom I had the highest personal regard as doctor, scientist and pioneer cardiologist, in his vehement attack on laboratory methods—an attack difficult to understand in one who in his early years made use of precision instruments with the greatest advantage to medicine. I can explain it only on the ground that many a great man when he grows old becomes a *laudator temporis acti.*

There is no conflict between the bedside and the laboratory. Indeed the bedside may also be considered a laboratory. The problems of clinical medicine, of bedside research, are as unlimited as are the problems of laboratory research and to my mind a good conscientious clinical essay is as valuable a contribution as a laboratory essay, even if that is filled with quadratic equations and estimations of the pH to the tenth decimal.

The physician who would be an artist in medicine must, like the artist mason of whom I have spoken, have the fundamental skill or science to build on. His foundations must be solid and he must understand the use of plumb and level. Bedside manner otherwise becomes a mere veneer.

A doctor must not only read medicine; if he has ambition and enthusiasm he will read much else besides. Everything that extends his antennae makes him a better physician. For that reason I am an ardent advocate of a hobby for every medical man. A hobby has a subjective value—it is a haven of rest for the tired mind, and it has an objective value

in that it gives additional points of contact with intelligent patients and may form the basis of brief conversation that adds to the pleasure of the doctor's visit. It may even lead to friendships that otherwise would not be formed.

The American is what Paul Leicester Ford calls Peter Sterling, a practical idealist. Better perhaps than any other national he can combine the ideals of the art of medicine with the ideals of the laboratory. Under that combined egis medicine will become a greater and a grander profession, more scientific in the sense of understanding better the physiologic basis of life and health and a nobler art in its profound insight into the human soul which can not be weighed in the balance or seen through the microscope.

OBITUARY

EDWARD SKINNER KING

ON September 10 Professor Edward Skinner King, astronomer for more than forty years at the Harvard College Observatory, died at his home in Cambridge, Massachusetts, after a short illness. He was born at Liverpool, New York, on May 31, 1861, and obtained his education in the schools of that state, receiving his degree from Hamilton College: an A.B. degree in 1887, an A.M. in 1890 and an honorary Sc.D. in 1927. While at Hamilton he specialized in mathematics and the classics, taking several of the coveted prizes in mathematics, and was elected a member of Phi Beta Kappa.

During his college days he came under the guidance of Professor C. F. W. Peters, upon whose suggestion he applied, immediately following his graduation, for a place on the staff of the Harvard College Observatory. Appointed an assistant in 1887, he was connected with the observatory thereafter almost continuously until his death. There was an interval of about three years in the early nineties when he was compelled to give up active duty because of ill health.

During all these years Professor King was in charge of astronomical photography at Cambridge, developing new methods of clock control, instrumental guiding and plate testing. He was a pioneer in the subject of photographic photometry, and made a special determination of color differences in stars, as observed photographically and visually. He was the first successfully to photograph the Aurora and the spectrum of lightning, and was likewise the first to observe star occultations by photographic means. The results of his scientific work are to be found in the various Harvard Observatory publications and include, among others, discussions on the absorption of photographic wedges, photographic photometry, lunar photometry, tests of photographic plates, transformation of prismatic to normal spectra, absorption medium in space, out of focus results on magnitudes of stars, eclipses of Jupiter's satellites, and photo-visual magnitudes of stars and planets.

For more than ten years Professor King contributed biweekly articles on astronomy to one of the prominent newspapers of the country, and in this connection devised and published his "Star Maps." He was coauthor of the "Harvard Radio Talks," better known as "The Universe of Stars." In 1930 he produced his "Manual of Celestial Photography," an authoritative and unique treatise on how to take celestial photographs.

Professor King became assistant professor of astronomy in 1913, and in 1926 was made Phillips professor, a chair which he held until September first of this year, when he became professor emeritus. He was a member of numerous scientific societies, among which were the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the International Astronomical Union, the Société Astronomique de France, the Bond Astronomical Club, the Nantucket Maria Mitchell Association, and the American Astronomical Society, of which, at the time of his death, he was a member of the council.

He was married in 1890 to Miss Kate Irene Colson, of Batchellerville, New York, to whom three children were born: Dr. Harold Skinner King, now associate professor of chemistry at Dalhousie University, Halifax, N. S.; Margaret W., wife of Professor J. C. Manry, of the University of Iowa, and Everett T., who died in 1917.

LEON CAMPBELL

MEMORIALS

To celebrate the centenary of the British Medical Association the council has opened a fund for the purpose of establishing a permanent memorial to its founder, Sir Charles Hastings. The *British Medical Journal* reports that the memorial will take the form of a stained-glass window in the cathedral at Worcester, a city with which he was intimately associated all his life; the placing of a tablet on the house in Worcester in which he practised; and the restoration and permanent upkeep of his grave in the Astwood Cemetery, Worcester. Any balance left over after these objects have been fulfilled will be given to the Sir Charles Hastings Fund, which is controlled by a small body of trustees, who have power to distribute the income for the benefit of individual members of the profession or their dependents in any way that

the trustees may think fit. The fund has proved exceedingly useful in cases which do not come within the ordinary scope of the Royal Medical Benevolent Fund and in cases in which there is urgent need for help.

RECENT DEATHS

Dr. L. L. Van Slyke, chemist at the New York State Agricultural Experiment Station at Geneva and professor of dairy chemistry at Cornell University, died on October 1. He was seventy-two years old.

Dr. Willis A. Slater, director of the Fritz engineering laboratory at Lehigh University and formerly engineer physicist at the U. S. Bureau of Standards, died on October 6 at the age of fifty-three.

Dr. George Thomson Elliot, emeritus professor of dermatology at Cornell University Medical College, died on September 14. Dr. Elliot was seventy-six years of age.

Mr. Alfred J. Henry, senior meteorologist in the U. S. Weather Bureau and editor of the *Monthly Weather Review*, died on October 5, aged seventy-three years.

Dr. James W. Gidley, assistant curator of fossil mammals at the U. S. National Museum, died on September 26. He was sixty-five years of age.

Dr. J. Madison Taylor, professor of physical therapeutics and dietetics at Temple University, died on October 3 at the age of seventy-seven years.

Professor Josiah W. Votey, dean of the College of Engineering at the University of Vermont, died on September 16, at the age of seventy-one years.

Mr. Andrew J. Wiley, well-known consulting engineer, died on October 7. He was sixty-nine years of age.

Sir William John Ritchie Simpson, director of tropical hygiene at the Ross Institute, Putney, editor of the *Journal of Tropical Medicine*, and emeritus professor of hygiene and public health at King's College of the University of London, died on September 20, at the age of seventy-six years.

Dr. Percy Groom, professor of the technology of woods and fibers at the Imperial College of Science and Technology, died suddenly on September 16. Dr. Groom was sixty-six years of age.

Colonel the Honorable Milo G. Talbot, who was awarded a Royal Medal of the Royal Geographical Society in 1909 and who was known for his surveys of the northwest frontier of India and Anglo-Egyptian Sudan, died on September 3 at the age of seventy-six years.

SCIENTIFIC EVENTS

THE METALLURGICAL ADVISORY BOARD

The fifth annual open meeting of the metallurgical advisory board to the Carnegie Institute of Technology and the U. S. Bureau of Mines will be held on Friday, October 16, on the campus of the institute, in Pittsburgh. The progress made on research problems undertaken jointly by the Carnegie Institute and the U. S. Bureau of Mines will be discussed during the morning and afternoon sessions by investigators from the two laboratories.

Mr. Charles F. Abbott, executive director of the American Institute of Steel Construction, Inc., will be the principal speaker at the evening session, which will follow an informal dinner at the Hotel Schenley. Mr. Abbott's subject will be "Market Research in the Steel Industry." Dr. Thomas S. Baker, president of the Carnegie Institute of Technology and organizer of the advisory board, will preside at the evening session.

The morning meeting will be devoted to reports and discussions on iron-manganese-carbon alloys and chrome-nickel alloys. Reports on research work will be given by Dr. Francis M. Walters, Jr., director of the Bureau of Metallurgical Research of the Carnegie Institute; Dr. V. N. Krivobok, metallurgist of the same bureau, and Maxwell Gensamer and Cyril Wells, assistants. Dr. C. H. Herty, Jr., physical chemist, and M. B. Royer, assistant metallurgist, of the U. S. Bureau of Mines, will deliver a report on the solubility of carbon in iron-manganese-silicon alloys. Dr. G. R. Fitterer, associate metallurgist of the U. S. Bureau of Mines, will report on the electrolytic method for the determination of inclusions in steel. Other reports will be delivered by the same investigators.

The physical chemistry of steel-making will be reported on and discussed at the afternoon session. The three outstanding contributions from this work are the development of a new manganese-silicon deoxidizer, which has been shown to be much superior to ferro-manganese ferro-silicon in combination in producing clean steel at a low cost; the development of a method for quantitatively determining non-metallic inclusions in plain-carbon steels; and the determination of the factors which affect the oxidation of steel in the open-hearth furnace. These reports will be made by Dr. Herty and members of the staff of the U. S. Bureau of Mines. The several reports will be interspersed with discussions by metallurgists from the industry.

The laboratories of the U. S. Bureau of Mines and of the Carnegie Institute of Technology will be open for inspection on the morning of October 17. Members of the staffs will be present for informal discussions on the work which is being done.

THE INSTITUTE OF PAPER CHEMISTRY

THE new building to house the Institute of Paper Chemistry at Lawrence College, was dedicated on September 23. We learn from *The New York Times* that an announcement was made of a gift of $100,000 to the institute by Mr. J. C. Kimberly, president of the Kimberly Clark Company, in memory of his father, Mr. J. A. Kimberly, who was among the first students to enter the doors of Main Hall at Lawrence College when it was built, more than seventy-six years ago. The elder Mr. Kimberly was for half a century a pioneer in the pulp and paper industry.

In the words of Mr. Ernst Mahler, president of the institute and a vice-president of the Kimberly Clark Company, "the gift will be used to erect, contiguous to the present building, a library and laboratory to house the splendid collection of books we possess and to make provision for its growth, and to provide additional laboratory space, already shown desirable."

Other gifts of $15,000, to be made available for additional fellowships and scholarships for institute students during the next three years, were also announced.

President Herbert Hoover sent a letter of commendation to Mr. Mahler on the organization of the institute. The program at the dedication began with a procession of the faculty of Lawrence College, with which the institute is affiliated, and included the presentation by Mr. Mahler of the keys of the institute to the president of Lawrence College, Dr. Henry M. Wriston, who paid tribute to the "enthusiastic and energetic labors of the members of the board of trustees."

Dr. John H. Finley, associate editor of *The New York Times,* in the dedicatory address congratulated Lawrence College, a liberal arts institution, on its having an affiliated graduate school to be devoted completely to the interests of research in the pulp and paper industry.

The ceremony brought a number of the leaders of the pulp and paper industry to Lawrence and the institute. Guests at a luncheon held in connection with the dedication included Mr. M. A. Krimmel, chief chemist of the Hammermill Paper Company and president of the Technical Association of the Pulp and Paper Industry; Colonel Benjamin E. Franklin, president of the Writing Paper Manufacturers' Association and vice-president of the Strathmore Paper Company of Massachusetts, and S. L. Willson, president of the American Pulp and Paper Association. In their addresses they praised the institute as a means of supplying a much-needed technical training for newcomers in the industry and lauded the men who have pioneered in its founding.

The school is patterned after the Darmstadt school in Germany and is the only one of its kind in the United States. Several large grants were given when it was organized, and twenty-six students from universities throughout the country entered classes in 1930, under a faculty of nine. Complete paper-making processes are studied.

The purpose of the institute is threefold—to train talented college graduates in pulp and paper chemistry, to establish a comprehensive research library and information service for use of the paper industries and institute, and to coordinate research in the interest of the whole industry.

Opened first with Dr. Otto Kress as technical director, the institute has begun its new session with twenty-seven students, graduates of twenty-two colleges and universities and residents of sixteen states.

It operates on a budget equal to the income from more than $1,000,000 endowment.

About $250,000 is invested in the plant and apparatus, the institute having in its new building the finest arrangement of optical instruments, the most exact constant-humidity and constant-temperature rooms to be found, it is said, in educational institutions in America. More than 225 mills and corporations throughout the United States have contributed instruments, materials and apparatus for use in its construction and operation.

THE FIVE-YEAR PROGRAM OF THE KENTUCKY GEOLOGICAL SURVEY

THE Kentucky Geological Survey has just brought to completion its five-year program of detailed mapping of the areal and structural geology of the Blue Grass Region of Kentucky. This portion of the state—one of the choice agricultural areas of the entire country, is equivalent to the Ordovician exposure of northern-central Kentucky. In this region new base maps have been prepared at the scale of one inch to the mile, utilizing topographical surveys wherever possible for each of the counties involved. On these new county maps the areal and structural geology has been executed and with the completion of the map of Scott County, which is now shortly to be issued, new inch-to-the-mile areal and structural maps have become available for all parts of the Ordovician exposure in the northern-central part of the state. The following county maps have been prepared and have been issued separately: Boone, Kenton, Campbell, Gallatin, Grant, Pendleton, Bracken,

Mason, Fleming, Nicholas, Bath, Harrison, Owen, Carroll, Trimble, Oldham, Henry, Franklin, Shelby, Jefferson, Spencer, Bullitt, Nelson, Washington, Marion, Boyle, Mercer, Anderson, Woodford, Fayette, Jessamine, Garrard, Lincoln, Madison, Clark, Montgomery, Bourbon, Robertson and Scott.

While it is true that some of these maps overlap the periphery of the Blue Grass region and extend into the well-known Kentucky Knobs region, it is a fact there are to-day no areas within the Blue Grass which are not surveyed. These new county maps are available to the general public for a nominal sum from the office of the Kentucky Geological Survey at Frankfort, Kentucky.

With the exception of Garrard, Woodford and Fayette, all these county maps have been published by lithographic processes in standard colors on the scale of one inch to the mile. The usual divisions of the Kentucky Ordovician, ranging from and including the Richmond of the Upper Cincinnatian through to the High Bridge of the Champlainian, have been shown by outcrop. This area encompasses about 8,000 square miles and constitutes the largest unit outcrop of Ordovician sediments mapped areally and structurally in detail in the world.

PSYCHOLOGICAL EXPEDITION TO CENTRAL ASIA

IN July, 1931, the Uzbek Research Institute of Samarkand, together with the Moscow Institute of Experimental Psychology, organized the first expedition of the Soviet Union for the study of psychological characteristics of peoples in various stages of cultural development. The aim of the expedition was to investigate the variations in thought and other psychological processes of people living in a very primitive economic and social environment, and to record those changes which develop as a result of the introduction of higher and more complex forms of economic life and the raising of the general cultural level.

One special task of the expedition was to develop new methods for evaluating intellectual status of individuals in very backward communities, because the usual methods of determining intelligence are inapplicable in the very special cultural conditions influencing the intellectual processes of the members of these groups. Another task was the preparation of educational methods which could be applied to these communities, such as the teaching of counting, reading, etc.

The expedition was organized under the direction of Professor Alexander Luria, of Moscow. The members of the expedition included Mr. P. I. Leventuev; Mr. V. N. Arbuzov; Mr. V. V. Zaharova; Mr. H. Ashrafi; Mr. A. Baiburova; Mr. L. S. Gazaryanz; Mr. A. D. Kolbin; Mr. E. N. Mordkovich; Mr. H. Hakimov; Mr. M. Hodzinova; Mr. F. N. Shemyakin; Mr. A. A. Usmanov, and Mr. R. Yussupov.

Before the expedition entered the territory, a two-months' seminar was conducted by Professor Luria in Samarkand in May and June, 1931, in which special topics were assigned, methods studied, and preliminary projects were carried out.

The expedition began its work in Uzbekistan with the native population. The chief work was done in the Alai Mountain region, and in the districts (*Kishlaki*) of Shahimardan, Yordan and adjacent uplands, where the people live under primitive nomadic conditions. The control territory was the region of the River Narin (Kishlak Utch-Kurgan), which has a very active cotton-raising industry and highly developed collective farming, but with a population still backward culturally.

Special attention was given to those socio-historical factors which influenced the development of the various stages of culture, and especially those changes which came as a result of the economic renascence of Central Asia. For the purposes of the research both territories were found to be very satisfactory. The following problems were taken up by members of the staff:

"The Structure of Perception in Various Stages of Cultural Development (Perception of Color, Form, and Optical Illusions)": Mr. L. S. Sazaryanz and Mr. E. N. Mordkovich.

"The Configuration of Vision in the System of Visual Thinking": Mr. A. R. Luria, Mr. L. S. Sazaryanz, Mr. E. N. Mordkovich and Mr. V. V. Zacharova.

"Structure of Elementary Intellectual Processes in Various Stages of Historico-psychological Development": Mr. A. Baiburova and Mr. H. Hakimov.

"Verbal Logical Configurations in the System of Visual Thinking": Mr. M. Hodzinova.

"Concept Formation in Stages of Cultural Development": Mr. A. D. Kolbin.

"The Development of Causal Thinking": Mr. P. I. Leventuev.

"Traditional Religious Thought in the Development of the Personality": Mr. A. D. Kolbin and Mr. H. Asharfi.

"Perception of Printed Material in a System of Visual Thinking": Mr. F. N. Shemyakin and Mr. P. Yussupov.

"Numerical Operations in a System of Visual Thinking": Mr. A. A. Usmanov and Mr. V. N. Arbuzov.

"Self-Analysis and Evaluation of Other Individuals at Various Stages of Personality Development": Mr. A. R. Luria and Mr. V. V. Zacharova.

All these studies will be published in the transactions of the expedition and some subsequently in foreign psychological journals. The expedition is an attempt at collective experimental research by a group of psychologists undertaken for investigation of psychological origins in human development. A

similar expedition will be organized in the summer of 1932 to continue the same work. It will have an international character, as it is planned to invite foreign psychologists to participate in it. All inquiries should be addressed to Professor A. R. Luria, Serebryani Pereulok 5, kv. 1, Moscow, U. S. S. R.

SCIENTIFIC NOTES AND NEWS

THE University of Pennsylvania conferred the honorary degree of doctor of science on Dr. Edgar Douglas Adrian, of Cambridge University, Foulerton professor of the Royal Society, on October 13.

DR. LAURENCE GOULD, geographer and geologist, who was second in command of the Byrd Antarctic expedition, will receive the gold medal of the Geographic Society of Chicago. Dr. Fay-Cooper Cole, of the University of Chicago, will present the medal at the annual post-vacation luncheon of the society in Chicago on October 31.

DR. H. J. GERSTENBERGER, professor of pediatrics in the School of Medicine of Western Reserve University, has been elected to honorary membership in the German Pediatric Society. He is the second American to be elected. Dr. Gerstenberger recently addressed the society at a meeting in Dresden on "A Study of Rickets Disease in the Babies' and Children's Hospital in Cleveland."

THE North Persian Forces Memorial Medal for 1930 has been awarded to Dr. T. F. Anderson, of the Colonial Medical Service of England, for his paper on "A Report on an Investigation of Health Conditions on Farms in the Trans-Nzoia, with Special Reference to Malaria," published in the *Kenya and East African Medical Journal* for January, 1930.

DR. AGNES BLUM, of the Kaiser Wilhelm Institute for Biology, has been awarded the Leibnitz silver medal by the Prussian Academy of Sciences for her work on alcohol and heredity.

DR. BURT R. SHURLY, of Detroit, has been made president-elect of the American Academy of Ophthalmology and Otolaryngology. Dr. Samuel Hanford McKee, of Montreal, has been elected president, and Dr. Gordon B. New, of Rochester, Minnesota, vice-president.

DR. JAMES RAMSAY HUNT, of New York City, has been made president of the American Psychopathological Association. Dr. L. Eugene Emerson, of Boston, was made secretary.

AT the Massachusetts Institute of Technology, Professor Charles F. Taylor has been made head of the department of aeronautical engineering; Dr. Louis J. Bircher, professor of physical chemistry at Vanderbilt University, is visiting professor of chemistry; Professor W. Spannhake, formerly professor at the Technische Hochschule in Karlsruhe, Germany, will conduct courses in hydraulic engineering; Dr. Ralph D. Bennett, for the past year research associate in cosmic rays at the University of Chicago, has been appointed associate professor of electrical engineering, and Dr. Louis B. Slichter, of the California Institute of Technology, associate professor of mathematics. The department of physics has added to its staff as assistant professors Dr. Philip M. Morse, Mr. V. Guillemin and Dr. W. B. Nottingham. Dr. Morse attended the University of Munich last year as international research fellow, while Dr. Nottingham was previously engaged in research work at the Bartol Foundation.

THE following appointments have been made at Tufts College: Mr. James R. Harrison, assistant professor of physics; Mr. Walter Miller, assistant professor of mathematics; Professor Alanson T. Warren, formerly of William and Mary College, professor of biology. In the medical and dental schools, Dr. Sydney C. Dalrymple, pathologist at the Newton Hospital, will instruct in pathology, Dr. Edward K. Ellis has been promoted from assistant professor to full professor in the department of ophthalmology, Dr. Allen Greenwood, professor of ophthalmology, has become professor emeritus, and Dr. M. Garcia Banus has been promoted from assistant to associate professor of physiology.

DR. GILBERT H. AYERS, of the University of Wisconsin, has been appointed assistant professor of chemistry at Smith College. Dr. Neal H. McCoy, National Research Council fellow in mathematics at Princeton University, has been appointed assistant professor of mathematics.

DR. B. F. CLARK, of the Massachusetts Institute of Technology, has been added to the faculty of Birmingham-Southern College as assistant professor of chemistry.

DR. EDWARD A. STRECKER, professor of nervous and mental diseases at Jefferson Medical College, has been appointed professor of psychiatry at the school of medicine of the University of Pennsylvania.

DR. GEORGE R. HERRMANN, associate professor of medicine in the school of medicine of Tulane University, has been appointed professor of clinical medicine at the school of medicine of the University of Texas.

AT the North Carolina College for Women, Greens-

boro, Dr. A. F. Thiel, associate plant pathologist of the U. S. Department of Agriculture at the University of Nebraska, has been appointed assistant professor of botany, and Mr. Charles Crittenden, assistant professor of geography.

DR. HERBERT RANDOLPH UNSWORTH, medical director of the De Paul Sanitarium and formerly director of the department of mental hygiene of the Louisiana state board of health, has been appointed assistant professor of neuropsychiatry at the new Louisiana State University Medical Center.

A FELLOWSHIP has been granted to Professor Jenaro Moreno Garcia-Conde, professor of mathematics at the School of Arts and Crafts, School of Military Engineers and at the Military Staff College, Santiago, Chile, by the John Simon Guggenheim Memorial Foundation, to study in the United States.

APPOINTMENTS at the Bartol Research Foundation include as new Bartol Research fellows Dr. T. J. Killian, formerly of the department of electrical engineering of the Massachusetts Institute of Technology, and Dr. J. C. Street, of the Rouss Physical Laboratory of the University of Virginia. Dr. K. T. Bainbridge, formerly National Research Council fellow at the Bartol Laboratory, has been appointed a Bartol Research fellow, and Dr. Thomas H. Johnson has been promoted to the position of assistant director.

DR. IVAN M. JOHNSTON, assistant at the Gray Herbarium, Harvard University, has been appointed research associate at the Arnold Arboretum.

DR. N. O. TRIBBLE, of Atlanta, Georgia, and Dr. Virgil McDaniel, of Seattle, Washington, have been appointed to fill vacancies in the drug control unit of the U. S. Federal Food and Drug Administration, caused by the recent resignations of Dr. J. J. Durrett and Dr. G. E. Clarke.

THE following members of the research staff of the Roessler and Hasslacher Chemical Company, Inc., have been transferred recently from the plant at Perth Amboy, New Jersey, to the plant at Niagara Falls, New York: Dr. Sterling Temple, Dr. B. S. Lacy, Dr. A. M. Muckenfuss, Dr. J. F. Reichert, Dr. C. J. Wernlund, Mr. A. T. Hawkinson, Mr. A. W. Rudel, Mr. J. M. Wainscott and Mr. H. A. Bond.

MR. R. D. BEAN, formerly manager of the engineering development department of the Brown Instrument Company, Philadelphia, has been promoted to chief engineer.

PROFESSOR HENRI FEHR, head of the department of mathematics at the University of Geneva, has been appointed rector of the university.

PROFESSOR J. C. MCLENNAN has retired as professor and director of the physical laboratory at the University of Toronto and will take up his residence in England.

DR. W. REID BLAIR, director of the New York Zoological Park, has returned to New York after spending five weeks in Europe in the interest of the preservation of the European bison. He announced that his mission had been successful. Within the next year a preserve for the bison, now scattered in the zoos of Europe, will be established in the Vialowsiska Forest, Poland, which formerly was the hunting preserve of the Czars and which since the war had been converted into a national park.

DR. R. S. BASSLER, of the department of geology, of the U. S. National Museum, returned on September 18 from six weeks' work in the various European museums and geological field studies in the London and Vienna basins and the Hungarian Plain.

DR. J. EASTMAN SHEEHAN, professor of plastic surgery of the N. Y. Post-Graduate Medical School, returned on October 7 on the *Olympic* from Paris, where he was attending the International Clinic of Plastic Surgery.

MR. EDWARD H. GRAHAM, assistant curator of botany at the Carnegie Museum, Pittsburgh, Pennsylvania, and Mrs. Graham have just returned from an extensive four months botanical collecting trip centering in the Uintah Mountains of northeastern Utah. A few weeks were spent at Mount Rainier, Washington, with Mr. and Mrs. Ottmar von Fuehrer, artists and taxidermists from the museum, where material was collected for an alpine plant habitat group to be installed as the fourth of a series of large plant groups now being completed in the museum's hall of botany.

PROFESSOR WILLIAM M. DAVIS is giving, in association with Professor Douglas Johnson, two courses on geomorphology at Columbia University this autumn, one a lecture course, the other a seminar. During October and November he will also give a course of six or seven lectures at Yale University on the "Origin of the Basin Ranges and on the Coral Reef Problem." At the end of the year he will return to Pasadena for a six months' engagement at the California Institute of Technology.

DR. ARTHUR L. BLOOMFIELD, professor of medicine in the Stanford University School of Medicine, gave the opening lecture at the school of medicine of the University of Southern California on September 15.

DR. B. V. CHRISTENSEN, head of the department of pharmacognosy and pharmacology of the college of pharmacy of the University of Florida, has been

elected to the post of chairman of the subcommittee on volatile oils of the U. S. Pharmacopoeial Revision Committee to succeed Dr. W. O. Richtmann, of the University of Wisconsin, who was elected last year and who recently resigned. The committee consists of fifty members selected from the leading chemists, physicians, pharmacognosists, pharmacologists and pharmacists of the United States.

THE department of agricultural chemistry of the University of Wisconsin has been awarded a grant from the American Medical Association for the study of the distribution of phosphorus in rachitic and normal blood. This work is to be under the immediate direction of Dr. C. A. Elvehjem.

A GRANT of $600 to Dr. G. de Takats, of the Northwestern University Medical School, for research work has been made by the committee on research of the American Medical Association.

THE Fourteenth International Physiological Congress will be held at Rome from August 29 to September 3, 1932. The dates have been set at this time to accommodate the American members. The congress will be held under the presidency of Professor Filippo Botazzi.

THE American Association of Railway Surgeons will hold its next annual meeting in St. Louis on November 4, 5 and 6. The Coronado Hotel has been selected as the headquarters. Arrangements have been completed for a joint meeting of the Association of Surgeons of the Illinois Central System with the American Association, and the program of the first day will be contributed by the surgeons of the Illinois Central System. The committee on arrangements is composed of Drs. R. A. Woolsey, *chairman;* O. B. Zeinert, Fred W. Bailey and R. E. Owen, of St. Louis, and F. H. Gunn, of East St. Louis. Dr. G. G. Dowdall, of Chicago, is president of the American Association of Railway Surgeons, and Dr. Louis J. Mitchell, of Chicago, is secretary.

WE learn from the *Journal* of the American Medical Association that the third International Congress of Radiology was held on September 11 in the Great Hall of the Sorbonne, in the presence of M. Camille Blaisot, minister of public health, and under the presidency of Dr. Béclère, aided by Madame Curie as honorary president. The addresses read by the delegates of foreign countries took up the first hours. Dr. Pfahler, in the name of the American radiologic societies, presented Dr. Béclère with an ivory gavel. Thereupon, Professor Forsell, after passing about the neck of the president the gold chain presented by the British Institute of Radiology, delivered an address on "The Crusade against Cancer." In greeting the 1,200 delegates of the forty countries represented at the congress, M. Blaisot declared that professional solidarity in the pursuit of scientific knowledge constituted one of the best means of maintaining peace among men. After the session the delegates went to the Elysée, where a reception was held in their honor. Dr. Béclère, assisted by the other officers of the society, presented the delegates to M. Paul Doumer. Owing to the financial situation, the German physicians were unable to participate in the congress.

THE Fifth Spanish Congress of Pediatrics will be held at Granada from October 19 to 23, under the presidency of Professor Suñer Ordoñez.

INDUSTRIAL research problems were discussed at a conference held at Purdue University on October 9 and 10, under the auspices of the Purdue Research Foundation. Plans for the gathering were announced by President E. C. Elliott, of the university. Invitations were sent to between 150 and 200 commercial and industrial leaders of Indiana and other Middle Western states to attend the meeting and also to be present at a dinner on the evening of October 9, at which David E. Ross, president of the board of trustees of Purdue University and a director of the Research Foundation, was the host. Speakers for the gathering included Dr. Harrison E. Howe, editor of *Industrial and Engineering Chemistry,* who was the principal speaker on the banquet program. Governor Harry G. Leslie, President Elliott and Mr. Ross also gave brief talks at the banquet. On October 10, John M. Moody, of New York City, well-known economist, who is regarded as a leading authority on financial topics, was the principal speaker. On the program with him was Howard W. Blakeslee, science editor of the Associated Press in New York City.

A GIFT of $1,000,000 to Atlanta University at Atlanta, Georgia, one of the pioneer institutions of higher learning for Negroes, from an anonymous friend of the university, was announced here yesterday by Dean Sage, president of the board of trustees. The buildings are to cost $625,000, and $40,000 will be expended in renovation. The remainder of the gift, $335,000, will be set aside as a building maintenance fund. The new buildings will be erected on a sixty-acre campus adjoining the campuses of the undergraduate colleges affiliated with the university, Morehouse College for men and Spelman College for women. More than 1,000 students enrolled last year in the three institutions. A new library was recently started, its cost of $300,000 provided by a grant from the General Education Board. Dr. John Hope is president of the university.

THE municipal council of Brussels, Belgium, has accepted a gift of $1,000,000 by George Eastman, of the Eastman Kodak Company, for construction of a dental clinic.

Plans for enlarging the present six-story biological and research laboratory at the Willard Parker Hospital of New York were filed by the department of health. The improvement will consist of an eight-story addition in East Sixteenth Street, between Avenue C and the East River. The annex will increase the hospital's plottage from 82 by 42 feet to 148 by 88 feet and will cost $700,000. The plans also provide for renovating the interior and renewal of equipment.

A large observatory is now being built for the Geophysical Institute of the University of Leipzig. The building, which will be surmounted by an eighty-foot tower, is being erected on solid rock in a forest on the Colm at Oschatz, a suburb of Leipzig. Nearby, in a small quarry, an "earthquake cellar" will be excavated for the observatory's seismograph, and two further buildings will be erected for the study of terrestrial magnetism. The main building will be chiefly devoted to the study of atmospheric electricity. All investigations will be carried out along the lines of international geophysical research.

One half of one gram of radium was delivered from Belgium on September 18 to the cancer division of Bellevue Hospital in New York. The total consignment, valued at $175,000, will be used exclusively in cancer treatments.

Dr. Herbert S. Dickey, explorer and ethnologist, returned recently after five and a half months' absence during which he made his fifth expedition up the Orinoco River and discovered its source, hitherto unvisited by white men. Arriving on the Munson liner *Munamar*, he stated that the source of this great river is not in Venezuela, but actually in Brazil, some sixty miles west of the Parima Mountains, the dividing line between the two countries.

The graduate division of the school of geography at Clark University has established headquarters at Wellfleet, Mass., for the fifth annual Clark Field School of Geography under supervision of Dr. W. Elmer Ekblaw, Dr. Wallace W. Atwood, Sr., president of the university, and Dr. Wallace W. Atwood, Jr. The group will survey the lower arm of the cape and then move the camp either to Brewster or Barnstable. The study is one step in what will eventually be a complete study of Massachusetts. During the past four years the Connecticut Valley has been the object of study.

We learn from the *Journal* of the American Medical Association that March 24, 1932, will be the fiftieth anniversary of the discovery by Robert Koch of the tubercle bacillus. The federal minister of the interior and the minister of the Prussian department of welfare have taken the initial steps to inaugurate suitable ceremonies in commemoration of the event. From May 17 to May 20, 1932, a commemorative assembly will be held in Berlin. On May 18 there will be a special commemorative session, in which German and foreign scientific men will participate, and on May 19 and 20 further scientific sessions will be held. It is planned also to reorganize under the name of the Robert Koch-Gedächtnis-Stiftung the Robert Koch foundation that was disorganized during the inflation period, and, above all, the importance of Koch as a scientist will be brought before the people in a suitable manner. Reichspräsident v. Hindenburg has consented to serve as the patron of the undertaking, and the imperial chancellor will be the honorary chairman of the committee on arrangements. In addition, a committee to aid in the organization of the scientific assembly will be appointed, to consist of German and foreign scientists and investigators.

The New Jersey state department of conservation and development has put into operation a new forest nursery to meet increased demands for tree seedlings and to provide better conditions for raising species best suited for planting in South Jersey. The nursery, which is located in the Green Bank State Forest, near Green Bank, Burlington County, will have an ultimate capacity of 6,000,000 seedlings.

Two excellent specimens of the Persian wild ass and four of the Persian wild goat have been received at the Field Museum as a result of the recent expedition conducted by James E. Baum, Jr. In the near future, one or more of the animals will be mounted for exhibition.

DISCUSSION

BILATERAL GYNANDROMORPHISM AND LATERAL HEMIHYPERTROPHY IN BIRDS

Bilateral gynandromorphism in birds constitutes a well-marked class of abnormalities, cases of which are, however, very rare. There are only ten cases recorded in the literature, more or less completely. In five of these cases there is agreement between external and internal sex characters of the same side of the body; the right side of the body possesses a testis internally and male plumage externally, while ovary or ovotestis (one case) and female plumage appear on the left side. These are the cases of Lorenz[1] (*Pyrrhula*),

[1] Th. Lorenz, *Bull.* de la Soc. des Nat., Moscow, n. s. 8, 325 (see p. 333), 1894.

of Weber[2] (*Fringilla*), of Heinroth and Poll[3, 4] (*Pyrrhula*), of Tikhomoroff[5] (*Pyrrhula*) and of Ogneff and Ogneff[6] (*Pyrrhula*). The apparently clean-cut situation presented by these cases has aroused great interest on account of its resemblance to the well-known bilateral gynandromorphs of insects. This resemblance naturally suggests an explanation similar to that demonstrated for the gynandromorphs of *Drosophila, i.e.,* somatic disjunction of sex-chromosomes. Such an explanation is, however, in conflict with an equally well-established principle of a physiological order, *viz.,* that the sex-characters of the plumage of birds are controlled by the female hormone which circulates in the blood, hence equally to the two sides of the body.

It is because the even distribution of the female sex hormone *seems* to exclude an explanation of bipartite distribution of sex-characters of plumage on a hormonal basis alone that the theory of somatic disjunction of sex-chromosomes is still appealed to as part at least of the explanation of this phenomenon. I shall, however, attempt to show that the principle of threshold of hormone action, as demonstrated for plumage characters by Juhn, Faulkner and Gustavson[7] and by Lillie and Juhn (in press) furnishes a complete explanation of the bipartite plumage characters in the five cases already cited, as well as in the other cases; the other abnormalities of all the cases also fall into well-known physiological categories.

We may first note that the theory of somatic disjunction of sex-chromosomes is of very doubtful validity as applied to this problem, even though advocated by Bond[8] and Goldschmidt,[9] and favored by Macklin[10] and Zawadowsky.[11] This is for the reason that it has been demonstrated on a large scale by experiments on fowls, both by surgical methods (see especially Domm[12]), and by injection of chemically prepared sex hormones (Juhn and Gustavson,[13] Juhn, Faulkner and Gustavson,[7] and Lillie and Juhn (in press)) that the sex of the soma makes no difference in the reaction of feather germs to the sex hormones. So far as sex-characters of plumage are concerned the male hormone is without any action, and the female hormone impresses the female characters on all feather germs of tracts exhibiting sex dimorphism, whether on a male or a female bird. The same would certainly be true, if one side of a single individual were male in its sex chromosome composition and the other side female. Somatic disjunction of sex chromosomes, even if granted, would therefore not help in explaining the phenomenon, unless it were shown that a different threshold of reaction exists for genetically male and genetically female feather germs. This assumption has no experimental support. So far as our experiments go, though not directed specifically to this exact point, no difference of threshold has been suspected between corresponding feather tracts in males and females.

The difficulty in the theory of somatic disjunction of sex chromosomes as applied to the problem in question does not, moreover, stop here. In the case of Bond's pheasant, for instance, not only was there a sex difference in the plumage of the two sides of the body, but the outer half of each tail feather was male and the inner half female *on both sides of the body.* We would therefore have to assume a second somatic disjunction for half of the germ of each tail feather on the male side of the body; and on the female side to provide for reacquisition of a lost chromosome in exactly half of each feather germ involved. That the plumage characters on the two sides of the body are not purely male or female in gynandromorph birds has also been noted by Lorenz[1] and Neunzig.[14]

Leaving aside therefore the sex chromosome mechanism, let us see how the matter can be explained on a purely physiological basis. We shall confine ourselves at first to plumage characters. The female hormone is the differentiating factor. The principle established by Juhn and Gustavson[13] and farther elaborated by Juhn, Faulkner and Gustavson[7] in my laboratory, *viz.,* that the threshold of reaction of feather germs to the female hormone is a direct function of their growth rate furnishes the basis of the explanation. By virtue of this principle they were able to produce from capons, at a given dosage of female hormone, birds in which the slowly growing saddle feathers, for instance, changed during regeneration to female, while the more rapidly growing breast feathers remained male. These are thus "transverse gynandromorphs" in plumage characters in the usual sense, but produced by a difference of hormone threshold in different feather tracts.

Now it must be noted here that, when a normal con-

[2] Max Weber, *Zool. Anz.,* 13, 508, 1890; Cabanis, *Journ. f. Ornithol.,* p. 344 (cited from Weber), 1874.

[3] O. Heinroth, Sitz. ber. Ges. naturf. Freunde zu Berlin, p. 328, 1909.

[4] H. Poll, *ibid.,* p. 331, 1909.

[5] A. Tikhomorow, *Rev. Zool. Russe,* 2, 196, 1918.

[6] Ogneff and S. Ogneff, *Rev. Zool. Russe,* 4, 259, 1924.

[7] Mary Juhn, G. H. Faulkner and R. G. Gustavson, *Journ. Exp. Zool.,* 58, 69, 1931.

[8] C. J. Bond, *Journ. of Genet.,* 3, 205, 1913.

[9] R. Goldschmidt, "Die sexuellen Zwischenstufen," Julius Springer, Berlin, 1931. See p. 479.

[10] M. T. Macklin, *Journ. Exp. Zool.,* 38, 355, 1923.

[11] M. M. Zawadowsky, *Arch. f. Entw. Mech.,* 108, 563, 1926.

[12] L. V. Domm, *Journ. Exp. Zool.,* 48, 31, 1927.

[13] Mary Juhn and R. G. Gustavson, *Journ. Exp. Zool.,* 56, 31, 1930.

[14] R. Neunzig, "Die gefiederte Welt," 53, 93, 1924.

centration of female hormone is present in the blood, all dimorphic feather tracts produce female feathers; this is the normal female condition. Gynandromorph conditions in the plumage, therefore, are dependent on a subnormal amount of female hormone, which can be regulated by dosage in castrates, as in the above experiments, or by ovarian deficiency, as in partially ovariotomized birds.

It is known that a testis usually develops on the right side of ovariotomized birds, owing to compensatory hypertrophy of the rudimentary right gonad (Domm[12] and Appel[15] and others). The existence of a testis on the right side and ovary on the left is presumptive evidence of ovarian deficiency in birds; and it is to be noted that the ovary is small in the case of gynandromorph birds, and generally immature, though it is difficult to be certain to what extent this may be due to seasonal conditions. In Bond's case there was an ovotestis on the left side and no gonad on the right, so that there is a lack of correspondence of internal and external gynandromorphism.

The presumption is therefore strongly in favor of a condition of ovarian deficiency in all cases, seven in number, in which the condition of the reproductive organs is reported. We have, therefore, in these birds conditions favorable for the occurrence of gynandromorph conditions in the plumage. The problem to be solved is its bilateral distribution, whether in the plumage as a whole, or in individual feathers as in Bond's case.

If the cases in the literature be examined again, a very striking fact comes to light, which has not hitherto been emphasized, *viz.*, that the side on which the male plumage appears is hypertrophied as compared with the opposite side in the four cases in which data exist. Thus in Poll's case the author notes incidentally that the right wing is much larger than the left; the photograph, moreover, gives the impression that the right tarsus is also longer and heavier than the left. In Ogneff and Ogneff's case the right wing is similarly reported to be somewhat longer than the left. In Neunzig's case, also of *Pyrrhula*, it is the left side that exhibits the male plumage, the right side being predominantly female. Although the author fails to mention asymmetry, yet his figure of the bird shows the left foot very much larger than the right. In Bond's case the left tarsus and phalanges are larger than the right, and there are other evidences of hypertrophy of the left side, which is the male side in this case. The hypertrophy occurs on opposite sides in these cases, two on the right and two on the left, and *the male plumage is on the hypertrophied side in each case*. Macklin's case was an extreme example of hemihypertrophy (right), but unfortunately the fowl was plucked before it was received for study, so that the plumage characters were known by report only and very incompletely. In the other cases, six in number, no observations were recorded on symmetry or asymmetry.

Congenital hemihypertrophy in man is well known clinically, though it is a rather rare condition. Gesell[16] made a particularly careful study of the condition. Stanton and Tuft[17] state that 41 cases were on record at that time; more cases have been recorded since. The right side is more often affected than the left, but the condition may occur on either side; it occurs in both males and females. Besides the differences in size on the two sides of the body, which are often extreme, the hypertrophied side, according to these authors, may exhibit excessive sebaceous and sweat secretion, thicker growth of hair, more rapid growth of nails, higher temperature by a degree or two, and earlier eruption of teeth.

The hypertrophied side has a higher growth rate than the normal side in the clinical cases, evidenced not only by the larger size of all parts, but also by the more rapid growth of continuously growing structures on this side, such as nails and hairs.

In a paper by Lillie and Juhn now ready for press it is shown that the patterns of individual feathers are largely dependent on a differential growth rate along the axes of the barbs. Moreover, in highly asymmetrical feathers, in which the level of growth rate of all the barbs of one side of the feather is higher than on the other, it is possible to produce bilateral gynandromorphism by injections of female hormone regulated so that its concentration is above the threshold of reaction on the less rapidly growing side and below it on the other.

Therefore, in cases of pronounced hemihypertrophy in birds, in which ovarian deficiency exists, we would expect that the plumage of the more rapidly growing (hypertrophied) side would be male, if the threshold corresponding to its growth rate were above the existing hormone concentration, while that of the opposite side might be female corresponding to a slower growth rate. The degree to which this condition would be expressed would depend on the time of origin of the ovarian deficiency and its duration and extent in relation to moulting periods. The condition need not be pure with reference to the two sides; this would be a matter of fluctuating concentration of the female hormone; and it is noticeable that in the case of Bond's pheasant, Neunzig's bulfinch and some other cases, it is far from being so, which constitutes an-

[15] F. W. Appel, *Journ. Exp. Zool.*, 53, 77, 1929.

[16] Arnold Gesell, *Arch. of Neur. and Psych.*, 6, 400, 1921.

[17] James Stanton and Louis Tuft, *Journ.* Am. Med. Ass., 80, 1,432, 1923.

other difficulty for the theory of somatic disjunction of chromosomes. Moreover, the same condition would account for the bilateral gynandromorphism of individual feathers.

These principles fit the situation so perfectly in all respect that I have no hesitation in presenting the theory that these gynandromorph birds are cases of hemihypertrophy combined with ovarian deficiency, as by far the most reasonable interpretation. The theory has the very great advantages of requiring no subsidiary hypotheses and of being in accord with well-known physiological principles.

If such lateral hemihypertrophy were to occur in a male bird, gynandromorph characters would not appear, for no ovarian tissue occurs in males. Crew's[18] case of lateral asymmetry in a male resulting from a cross between Light Sussex ♀ and a Rhode Island Red ♂ is a case in point. The bird was male externally and internally; the left side was much hypertrophied, especially in the skeleton, with the exception of the skull and vertebral column which were practically symmetrical. The left leg was pinky white, somewhat like the color in the Light Sussex, and the right leg yellow like the Rhode Island Red. This difference suggested the theory that an autosome carrying the dominant factor for white epidermal pigment had been eliminated during early cleavage divisions of a male zygote heterozygous for white and yellow, though it is somewhat difficult to correlate this with the general hypertrophy of the left side, as Crew admits. If, on the other hand, we assume that the lateral hemihypertrophy is the primary factor in this case, the other asymmetrical features might conceivably receive a consistent physiological explanation.

The data suggest that it would be profitable to look for cases of lateral hemihypertrophy in birds, with a view to ascertaining how common the phenomenon is, and what other asymmetrical characters may be associated with it. It would be particularly desirable to ascertain if in the female it is always associated with gonadal abnormalities, or whether the fact that it is so far known in females only in such association, is due to the interest that has attached to gynandromorphism and the lack of interest in asymmetry as such.

The interpretation of hemihypertrophy itself has been dealt with by Gesell[16] and by Newman.[19] Gesell is inclined to interpret it as incipient twinning, thus explaining the degree of physiological isolation that seems to exist in such cases. To the writer these cases seem to be classifiable as extremes of the asymmetry that characterizes bilaterality in all organisms or parts of organisms. It may be, of course, that exaggeration of asymmetry of the germ in early stages is one of the causes that leads to twinning, a suggestion that would reconcile these two points of view. In the feather system of birds there are all possible degrees of asymmetry of individual feathers ranging from the barely perceptible to the most extreme types, and these gradations have certain regular relations to position on the body.

Without discussing the question farther in this place we may conclude at once by saying that the problem is much more surely one of the physiology of bilateral asymmetry than of differences of genetic constitution on the two sides of the body.

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[18] F. A. E. Crew, *Journ. of Genetics*, 20, 179, 1928.

[19] H. H. Newman, "The Physiology of Twinning," 230 pp. University of Chicago Press. 1923.

ANGUILLULA ACETI—A DESIRABLE NEMA FOR TYPE STUDY

DR. N. A. COBB'S excellent summary of recent advances in nematology, in these pages, prompts the writer to give his own experience in teaching the subject. Early attempts with mixed classes of students forcefully demonstrated the impracticability of using such forms as *Ascaris* and *Gigantorhynchus*. Considerable friction invariably resulted, some students positively refusing to dissect these forms and even dropping the course. To eliminate this friction, search was made for other forms, the little vinegar eel, *Anguillula aceti*, being finally selected for type study. This nema yielded such satisfactory results that it was subsequently adopted by the writer for use in his general biology, zoology and parasitology classes.

The following reasons induced the above selection of *A. aceti*.

(1) It arouses real interest in and elicits favorable comments from the students.

(2) It may be procured at any time of the year from a corner grocery by asking for bulk cider vinegar.

(3) It will live indefinitely in the laboratory if transferred to fresh vinegar every two weeks.

(4) It is a simple nematode with a simple life history. The entire life history can be worked out in a single two-hour exercise.

(5) Being viviparous and transparent, all stages of development may be examined *in utero*.

(6) Anatomical details, such as alimentary tract, nerve ring, spicules and sperms of male, uterus and uterine development in female and all young and intermediate stages can be worked out with a 4 mm objective.

(7) Very spectacular effects can be produced by

placing living nemas in a well slide and projecting on a daylight screen with a microprojector. Under suitable magnifications many of the anatomical features may be shown on the screen in this way.

Individual studies were carried out from living and preserved material. This last was prepared by the writer in the following way: With a pipette, the vinegar eels were collected into a graduate until 50 ml of solution was obtained. This was then poured into an Erlenmyer flask containing 10 ml formalin and quickly heated over a Bunsen burner. The heat promptly kills and straightens the nemas and after about a minute they are removed from the flame and allowed to stand in the formalin for one hour. Subsequently they were filtered through a piece of silk cloth, placed in 50 per cent. alcohol for one hour and in 70 per cent. alcohol, to which last some Delafield's hematoxylin stain was added (5 ml of the stain to 50 ml of the alcohol). In this they may be kept indefinitely. For use a drop of the solution was given to each student on a slide. In such material all the forms indicated in the above outline could be found by every student. The nemas show no distortion, and all of the structures stand out clearly. If desired, this material may be further dehydrated and mounted in balsam, although the optical effects in this last medium are not as satisfactory as when examined in alcohol.

GEORGE ZEBROWSKI

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

SOME LABORATORY USES FOR CROWN SEALED MILK BOTTLES[1]

THE Crown Seal used for milk bottles is a metal cap similar to those used for beverage bottles, except that the milk bottle cap is larger. The cap is crimped tightly over the neck of the bottle and, with a suitable lining, is air tight.

In most bacteriological laboratories the storage of media is a problem. It is customary to sterilize media in large flasks plugged with cotton and to store these in the refrigerator. The flasks are relatively expensive and easily broken. To avoid boiling over of the media during sterilization and wetting of the cotton plugs the flasks may be filled only about two thirds full. They require a great deal of refrigerator space. Through the cotton plugs the media evaporate and are exposed to oxidation by atmospheric oxygen. In time molds may grow down through the cotton plugs. The use of milk bottles with cork-lined Crown Seals (Fig. 1) eliminates these difficulties. The bottles may

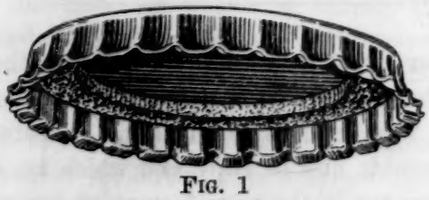


FIG. 1

be filled with media to within about two inches of the top. The caps are firmly crimped on by means of a suitable capping machine (Fig. 2) before the bottles are placed in the autoclave. During autoclaving the pressure outside should equalize that within the bottles and there is no leakage or boiling over if ordinary care is used in allowing the steam pressure to drop slowly at the end of the autoclaving period.

[1] From the Department of Pathology and Bacteriology, Johns Hopkins University, Baltimore, Md.

FIG. 2

The bottles of sterile media may be stored at room temperature in any convenient place. They require relatively little shelf room. There is no evaporation. There is little opportunity for oxidation since the air is excluded except for the small amount remaining over the media when the bottles are sealed. The bottles of media may be handled and shipped with no danger of leakage or contamination and little danger of breakage. The quality of glass obtainable in the milk bottles is fair. We have noted little chemical action on the glass. Occasionally a bottle may break under the influence of heat in the autoclave, especially if the bottles have been filled with cold media. Efforts are being made to procure Pyrex bottles for this purpose. The cost of the milk bottles is very low as compared with that of laboratory glassware.

The metal caps cost a fraction of a cent each. The cost of the sturdy capping machine shown in Fig. 2 is about $35.00 and a cheaper one is procurable. The quart bottle seems to be the best size. It fits into the autoclave, allows ready penetration of heat and stores conveniently on shelves. There is no disadvantage in having to distribute a large lot of medium into a number of bottles. The large mouth milk bottle is more convenient to fill and to pour from (especially for agar) than the small mouth beverage bottle.

In 1925 I reported on "The Preservation of Bacteria in Vacuo."[2] Dried on small bits of filter paper in a vacuum bottle most bacteria remain viable without transplanting for many years. The dried cultures were enclosed in pint milk bottles, the mouths of which were ground down flat against small glass plates and these were sealed with a wax mixture. The labor and difficulty of grinding down the bottles against the glass plates has doubtless discouraged the more general use of this method of preserving cultures. We now find that a smaller milk bottle (one half pint) with a metal Crown Seal which has a special rubber composition ring lining makes a much more convenient and readily available vacuum bottle at small cost. The cultures, smeared on small bits of sterile filter paper in small cotton-plugged vials, are placed over some dehydrating agent (calcium chloride has been used) in the bottle. The edge of the bottle is rimmed with vaseline to make a more perfect contact with the rubber ring in the cap. The cap is placed lightly over the bottle (not crimped) and the bottle is placed under the bell jar of a vacuum pump. When a vacuum has been established within the bell jar the air is admitted suddenly. The inrush of air into the bell jar closes the bottle immediately without entering the bottle. To insure a permanent seal the bottle is then placed under the capping machine and the cap securely fastened into place. After using these bottles for several months we have noted no leakage as indicated by small manometers placed within the bottles.

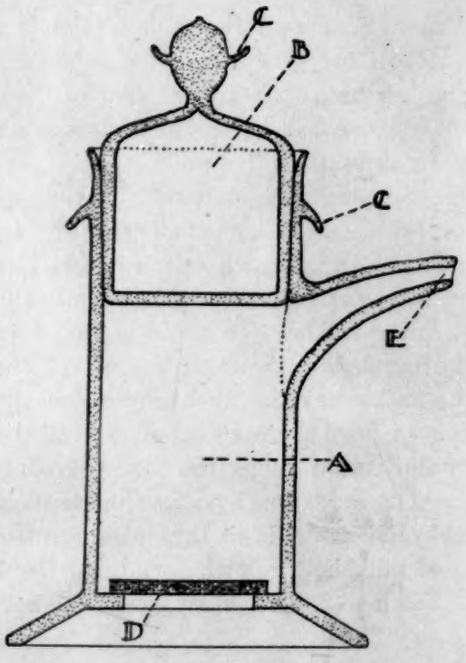
Quart milk bottles serve very well for the cultivation of anaerobic bacteria in test tubes. Pyrogallol and a strong solution of sodium carbonate are placed in the bottle along with the culture tubes and the bottle is promptly and securely sealed with one of the rubber composition lined caps.

J. HOWARD BROWN

A DILATOMETER FOR MEASURING THE SWELLING OF SEEDS

THE dilatometer here described—for measuring the rate and amount of swelling when immersed in an aqueous solution of seeds, dried fruits or other objects composed of or containing water-imbibing colloidal materials—is of the type in which the increase in volume of the test object is evidenced by the displacement of shot or sand surrounding it. The distinctive feature of the instrument is the avoidance of the use of metal in contact with the solution in which the test object is immersed, and is made possible by the utilization for the purpose in hand of two products of the glass industry which have recently appeared on the market:

(1) For the bottom wall of the dilatometer chamber, which is perforated to permit the flow of water through it, the perforations being too small to allow the escape of any of the enclosed shot or sand, use is made of a fritted glass filter disc manufactured by Schott and Gen., of Jena, Germany. In addition to avoiding the use of metal, this has the additional advantage of being more rigid than wire cloth.



(2) For the shot or sand surrounding the test object in the dilatometer chamber use is made of glass beads of very small sizes which are manufactured in Czechoslovakia and in Italy and which are employed in this country in the manufacture of decorative furniture novelties to produce a "crystal frosting" effect on fabric and paper surfaces. These glass beads are obtainable in sizes as small as 0.25 mm diameter, and in bright colors as well as in untinted glass. They are perfect spherules and roll and glide easily over one another when wet as well as when dry; they are greatly superior in this respect to the best grades of silica sand commercially obtainable. As compared with lead or steel shot these glass beads have the

[2] Abstracts of Bacteriology, ix: 1, p. 8, January, 1925.

obvious advantage of being of much lower specific gravity, in addition to being of a non-metallic material.

In the accompanying line cut, illustrating the instrument in vertical section, "D" indicates the fritted glass filter disc cemented into the bottom wall of the chamber "A." A wide opening is provided at the top of the chamber for insertion of the test object (not shown) and filling with the glass beads (also not shown). After having been thus filled, the dilatometer chamber is closed by the hollow ground glass stopper "B" which is held in place, against the pressure developed in the chamber, by strong rubber bands wound around the projecting hooks "C" on the stopper and on the outside chamber wall. The dilatometer is then immersed in the solution the swelling effect of which on the test object is to be determined, above the level of the orifice "E" but below that of the hooks "C" on the outside chamber wall, to avoid immersion of the rubber bands in the solution. As the test object in the dilatometer chamber swells, glass beads are extruded from the chamber through the orifice "E"—the number or volume of the beads extruded serving as an indication of the increase in size of the test object in the chamber.

It should be noted here that the volume occupied by a quantity of shot, sand or glass beads is not constant, but will vary somewhat with the packing of the particles.[1]

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SPECIAL ARTICLES

LAND TYPES OF THE TRINITY BEDS

THE Trinity beds are a conspicuous feature in the geology of the state of Texas. There they extend as a broad belt thirty or so miles wide for a distance of 300 miles from the Red River valley across Wise, Palopinto, Erath, Comanche and other counties, south-southwesterly to Fredericksburg (seventy miles due west of Austin). Along its eastern edge the Trinity overlaps the Pennsylvanian, and then south and west the beds run under several later horizons. The series consists in flotation sands, finer conglomerates and thin shelly, limy layers of fresh to brackish and fluvial marine origin, in all 500 feet thick. The invertebrates found in abundance at many points in thin interfingerings of limy rock are fairly well known. Also, R. T. Hill early used for the Trinity series the very good common name of "dinosaur beds" as further noted for their petrified forests, and somewhat later for three isolated and rare petrified cycads.

Occasional finds of land forms in the Trinity long gave little indication of wealth or variety of type; but other and fine discoveries have been accumulating for several years. Through the interest of Mr. Jene W. Wagner, of Burkburnett, Texas, and Mr. Bart Johnson, of Comanche, a splendid cycadeoid trunk from just east of the latter town was some years ago presented to the U. S. National Museum. This specimen I have sawn and studied in detail. Later, another handsome specimen from the neighborhood of Fredericksburg was turned over to Dr. Sellards, of the Texas survey; and I have since cut this stem, which bears young fronds. While, on visiting the general locality with Professor Plummer, of the University of Texas, early this year, we collected additional specimens as associated with the conifers. Again, Mr. Ross R. Wolfe, of Stephenville (Erath County), through persistent inquiry and effort has assembled a varied and most important series of the cycadeoid stems from the Stephenville country. Of these he has donated representative forms to Yale.

During a visit to Stephenville last March and April, aided by Mr. Wolfe and other friends, I was enabled to see why the land types of the Trinity beds and the general facts relating to them have appeared to view rather slowly. In that grassed and forested country fossil hunting is not easy. But the cycads can be found, and it is not too much to say that, considering their wide extent, the Trinity beds must be ranked as one of the five great cycad-yielding terranes of North America—the other four being the Arundel of Maryland, the Lakota of the Black Hills region, the Como of the Black and Freeze Out Hills, and the Mesaverde of the Chuska Mountain region of New Mexico and Arizona.

On inquiry, it was learned that some ten miles from Stephenville along the Paluxy River various portions of a reptilian had been noted. A visit to the locality resulted in the assemblage of a large part of the skeleton of a dinosaurian standing about six feet high at the hips, and thus one of the few lower Cretaceous dinosaurs from North America. Accurate determination of the form and species is greatly to be desired. It was found, too, that the general locality yields small Testudinates. In addition, large serial three-toed dinosaur tracks were pointed out as they occurred. A single track of yet larger form had been found; and cutting across a stream bed three miles from Glen Rose, another and splendid bipedal series of lesser three-toed tracks was seen. These latter tracks could have pertained to the skeletal type of the Paluxy.

[1] Smith, Foote and Busang, *Physical Review*, 34: 1271–1274, 1929.

Regarding the associated conifer forests it may be added that the amount of petrified wood is enormous. The conservation is not favorable to study, but the general types can no doubt be determined with sufficient accuracy. The trees are seldom large, not much if at all exceeding two feet in diameter. The wood has been much gathered for more or less ornamental use in rock gardens at various points about the country of the Trinity terranes. Especially at Glen Rose and in several other villages a type of fossil bungalow (!) may be seen, in which the short lengths of petrified wood are freely used to face cement construction. The result is really ornate. Inside, the fireplace may also be built of the wood (!), which is sold in quantity at a low price for such building. The wood is thus definitely a commodity, the use of which might well be encouraged, so long as it does not go to the extreme of putting specimens of direct value to science into inappropriate places.

Five species of silicified cycadeoids are recognizable in the general series from the Trinity beds, which has finally reached importance, and should have further or preliminary mention now. The types and their localities may be listed as follows:

(1) *Cycadeoidea Boeseana* (Wieland, 1921). This type was found in the basal Trinity beds near Bridgeport, Wise County, by Dr. Emilio Boese in July, 1915, being the first petrified cycadeoid ever reported from this horizon in the state of Texas; although the *Cycadeoidea munita* (Cragin, 1889) from near Sharon in southern Kansas must come from beds of about the same age. The Boese type because of isolation and lack of fruits or leaves could only be named arbitrarily. Taken as a young stem it differs little from either the Arundel or the Lakota forms.

(2) *Cycadeoidea Barti.* A fine new type, the tallest yet found in the Trinity, from about one half mile east of Comanche, and named after Mr. Bart Johnson of that town, who donated it to the U. S. National Museum. The second specimen reported from the Trinity. The trunk has been freely cut and bears various young cones with elongate receptacular cushions. As more fully described (in MS) it appears in all its features to be very nearly related to several of the Black Hills types of the Lakota. This seems to be the type mainly occurring about Fredericksburg. A University of Texas trunk from there, which I have also cut, bears a few young fronds and is considered the same.

(3) *Cycadeoidea Wolfei.* A columnar type with scant ramentum and rather characteristic leaf base spirals, occurring about Stephenville. Again, resemblance to Black Hills types (*C. Stilwelli*) is seen. The species appears validly new as several examples have been secured by Mr. Wolfe, one of which he has kindly turned over to the Yale Collections. It is justly named for him.

(4) *Cycadeoidea Dyeri.* Slender, characteristically branched stems with drooping and much excised frond bases. An uncommonly handsome new species because of a habitus exactly intermediate between the robustly branched cycadeoids of the Lakota, and Williamsonia. The specimen selected as the type bifurcates near the base, and the longer axis then gives off two lesser branches, the height being 30 centimeters with a diameter above the basal branch of 11 centimeters. From near Tolar, Texas, and about Stephenville. Named for Miss Mamie Dyer of Tolar.

(5) *Cycadeoidea Johnstoni.* A nearly globular type, usually compressed during fossilization. Trunks complete, of large size, up to a foot and a half diameter, with nearly mature seed cones, and crowns of fronds up to 30 in number and forming a ring of large diameter about the crown of very numerous scale (?) leaves. Pinnules of the fronds as many as fifty in the lateral row (100 in all). Apparently never branched. Occurrence about Stephenville, but appears to recur in the Black Hills, since the seed cones are the same as those figured as *Cycadeoidea* sp. on Plate XXXII of my American Fossil Cycads, Vol. I. The present new type reopens the earlier question as to identity.

Many facts could be recited about the landscapes and types of the Trinity. The *Cycadeoidea Dyeri* is a new species of note. Originally the type was found a few miles out from Tolar, Hood County, Texas, and then later solidly set in mortar along with other fossils on the wall at the entrance of the post office there. But on the occasion of my visit, the amiable postmistress, Miss Mamie Dyer, concurred in the view that such a stem was of value to science. Only on removal from the wall did its fuller interest become apparent. And then Miss Dyer presented the fine specimen for the collection of cycads at Yale. It is well named for her. Other examples varying somewhat in form but with the branching feature always distinct occur; and, accompanied by Mrs. S. F. Davis (wife of Professor Davis, of the John Tarleton College), I had the fortune to find a second stem on the Harris farm near Stephenville. A terminal bud of a much larger and heavier cycad also found associated by Mrs. Davis belongs to the species *Cycadeoidea Johnstoni.*

Cycadeoidea Johnstoni is the best represented species of the Trinity beds as collections now stand, named after General Albert Sidney Johnston, the heroic figure of Shiloh. Celebrated in the annals of the Southwest of ninety years ago, a lover of nature and deeply interested in the physical sciences, he led an unresting life; he knew the petrified forests, and he carried often his treasured copy of Sir Charles Lyell in his saddle pockets. The type locality is on the Stone farm, ten miles from Stephenville, about the side of a low, flatly conical hilltop where beside fragments at least three large and complete specimens have been recovered. Considerable petrified

wood, mostly fragmentary, is also present. During a visit made with Mr. Wolfe and a large party late in March last, further armor fragments of the cycads were found. The conditions indicate that the general specimen level is undisturbed for some distance along the slope, and that more good material must be present. The exact position of this level measured in feet above the more basal of the "pack sands" can not long remain in doubt if this noteworthy cycadeoid locality, the finest so far known in the Trinity beds, is marked with care. A simple, tasteful, appropriately inscribed monument should here be set up. It would be doubly commemorative of discovery and distribution in the case of such a splendid fossil type, as again seen with such a near certainty in the Black Hills 900 miles north.

Taking the foregoing species and collections from the Trinity beds in fuller view, a group resemblance to the cycadeoids of the lower Lakota is at once discerned. The parallel extends to both simple stemmed and branched species—is, in fact, so close as to become outstanding for all North America. Whatever similarity the Maryland types may have is less evident, as little is known of their fruiting, and branching does not occur. So far as inference may rest on the cycadeoids, by now a most imposing group, the lower Greensand of the Isle of Wight, the lower portion at least of the Lakota carrying the great group of specimens at the Cycad National Monument in the southern Black Hills, and the Trinity beds, are all of quite the same age. It may still be asked whether the Arundel is recent as the Trinity, or old as the Como taken as the equivalent of the Wealden. The Trinity was a flat, subsident, river and bayou, cycad-dinosaur-conifer, forest land, swept by the shallow edges of the sea.

Most of the Trinity cycadeoids are not nearly so well petrified as the Lakota and Como specimens. Finer details of structure are seldom clear. Yet the series as a whole has the finest beauty and value, and often affords singularly handsome polished surfaces. The *Cycadeoidea Barti*, as found at Comanche and at Fredericksburg, has an appearance suggesting original calcification in whole or in part, with subsequent siliceous replacement.

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EFFECT OF H-ION CONCENTRATION ON THE DIVISION RATE OF PARAMECIUM AURELIA

EXPERIMENTS on the effect of hydrogen-ion concentration on the division rate of *Paramecium aurelia* have been performed, feeding the animals on a pure line of bacteria instead of the "mixed culture" of bacteria heretofore used in such experiments. The *Paramecium* used were from Professor Woodruff's pedigreed strain. The bacterium used was a strain of *Erythrobacillus prodigiosis* which has been kept for several years in the Department of Bacteriology of Yale University. The medium consisted of 1.493 gr. of powdered, desiccated lettuce leaves in 1.0 liter of distilled water. To this was added in the first group of experiments KH_2PO_4 buffer salt to form a M/600 solution. In the second group M/300 buffer was used. The animals were kept in isolation in depression slides, and changed daily under sterile conditions. No bacterial contamination was observed at the end of the experiments, but a very few yeast cells were observed at the end of one experiment. The temperature was controlled by a thermostat.

The lines were carried for ten days each at several different H-ion concentrations, produced by titrating with HCl or NaOH, with the following results:

GROUP 1. M/600 KH_2PO_4. Temperature 28° ± 0.5° C.

pH	No. of lines	Average division rate per 10 days
5.9	6	21.7
6.9	6	18.8
7.2	6	20.0

GROUP 2. M/300 KH_2PO_4. Temperature 26.5° ± 0.8° C.

pH	No. of lines	Average division rate per 10 days
7.0	6	14.0
7.7	6	14.0

It will be seen from the above that the division rate is practically unaffected by change in pH between the limits of pH 5.9 and 7.7. This is in striking contradiction to the very thorough work of Darby ('29),[1] who found a very marked variation in division rate with pH, using the same strain of *Paramecium aurelia*. The author believes that the discrepancy in results lies in the fact that Darby used a mixed strain of bacteria as food for the *Paramecium* as opposed to the pure line of bacteria used in the present work. It has been shown Hargitt and Fray ('17)[2] that over 30 species of bacteria may be represented in ordinary hay infusion. It has also been shown that these species differ greatly in their value as food for *Protozoa* (Hargitt and Fray,[2] Phillips,[3] etc.). It is well established that many of the common bacteria are stenionic and are greatly influenced in their growth

[1] H. H. Darby, *Arch. f. Protistenk.*, 65: 1, 1929.
[2] G. T. Hargitt and W. W. Fray, *Journ. Exp. Zool.*, 22: 421, 1917.
[3] R. L. Phillips, *Journ. Exp. Zool.*, 36: 135, 1922.

rate by changes in pH. Therefore it is logical to assume that the ecological balance among the bacteria will be greatly altered by changes of pH, and that where a large number of bacterial species are living together, as in a hay infusion, different species will predominate at different H-ion concentrations.

From the above it is concluded that the difference in division rate of *Paramecium* at different H-ion concentrations, between the limits of pH 5.9 and 7.7, at least, is due to a qualitative change in available bacterial food, and not to direct action of the pH on the Protozoa.

Further work is being carried on to determine the behavior of *Paramecium* in a pure culture of bacteria at higher and lower H-ion concentrations than those used in the present experiments.

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INDUCED AUTOTOMY IN THYONE

THE holothurian, *Thyone briareus,* has long been known to exhibit unusual autotomy. During this process it casts off the extreme anterior end including the ring of tentacles, calcareous lantern, water vascular ring, nerve ring and throws out with these organs the oesophagus, stomach and intestine.

A. S. Pearse,[1] by injecting strychnine into the body cavity of 20 Thyone, produced such evisceration in seven individuals. J. W. Scott,[2] induced autotomy in 40 out of 65 individuals by "allowing Thyone to stand in stagnant water until the water became foul" and then following with a "treatment with running water. Alternating these processes produced as high as 65 per cent. self-mutilated individuals."

During this summer's work at Woods Hole I have found that ammonia water will invariably bring about evisceration. Seven N ammonium hydroxide was used in the proportion of one part ammonia to 800 parts of sea water.

When the animal is placed in this solution there is usually a brief period of muscle relaxation and an expulsion from the cloaca of the water which filled the respiratory trees. Within 15 seconds the longitudinal and circular body muscles contract strongly, reducing the animal to minimum size. A few seconds of such contraction is followed by a gradual elongation of the anterior end of the body into which lantern, stomach, intestines and the fluid content of the body cavity are forced. As the pressure increases, the body wall about ¼ of an inch behind the tentacle ring becomes greatly distended. There are no strong circular muscles in this region. The body wall tissue in the distended region thins out and soon bursts allowing the body fluid to gush out carrying along with it part of the viscera. At this point in the procedure the Thyone is transferred to fresh sea water. Most of the viscera are tangled around the lantern, which is partly covered over with the small portion of the body wall anterior to the break. The strong circular muscles just posterior to the break contract so as to close tightly the body cavity at the anterior end. The whole procedure to this point occupies about 30 seconds. The original break in the tissue becomes gradually more extensive until within several hours the eviscerated parts are free from the body.

The hydroxides and carbonates of sodium and potassium have been used with some success. Electrical stimulation applied to the muscles of the body wall will also produce autotomy.

One hundred and fifty Thyone were eviscerated by the ammonia water method. Of this number five Thyone did not live. In each of these cases the body wall broke at places other than at the customary anterior point. One hundred and forty-five Thyone lived until they were killed for the study of the regenerated organs.

Under the conditions outlined, autotomy is regular and uniform in occurrence. In 96 per cent. of the possible cases it was favorable for continued life and the regeneration of lost parts. A study is being made of the regenerated tissues.

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[1] A. S. Pearse, "Autotomy in Holothurians," *Biol. Bull.*, vol. xviii, 1909.

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